Promise vs. Potential of Sustainable Biofuels

Biomass 2009: Fueling Our Future
Department of Energy

March 17, 2009

Congressman Roscoe Bartlett

www.bartlett.house.gov/EnergyUpdates

“Fossil fuels resemble capital in the bank. A prudent and responsible parent will use his capital sparingly in order to pass on to his children as much as possible of his inheritance. A selfish and irresponsible parent will squander it in riotous living and care not one whit how his offspring will fare.

Wood fuel and farm wastes are dubious as substitutes because of growing food requirements to be anticipated. Land is more likely to be used for food production than for tree crops; farm wastes may be more urgently needed to fertilize the soil than to fuel machines.”

“Energy Resources and Our Future" - by Admiral Hyman Rickover, May 14, 1957, St. Paul, MN

US Consumption of Energy By Resource

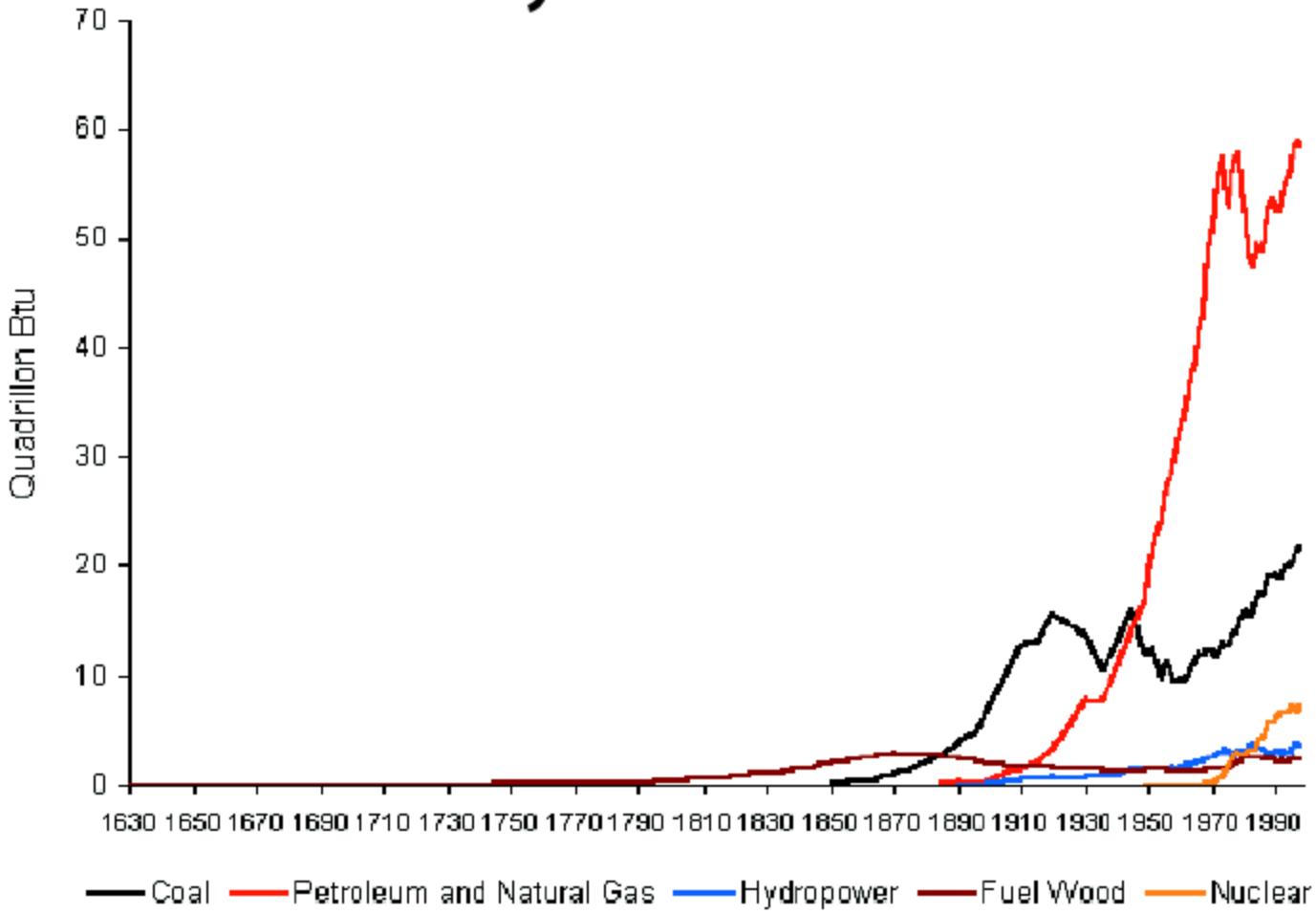
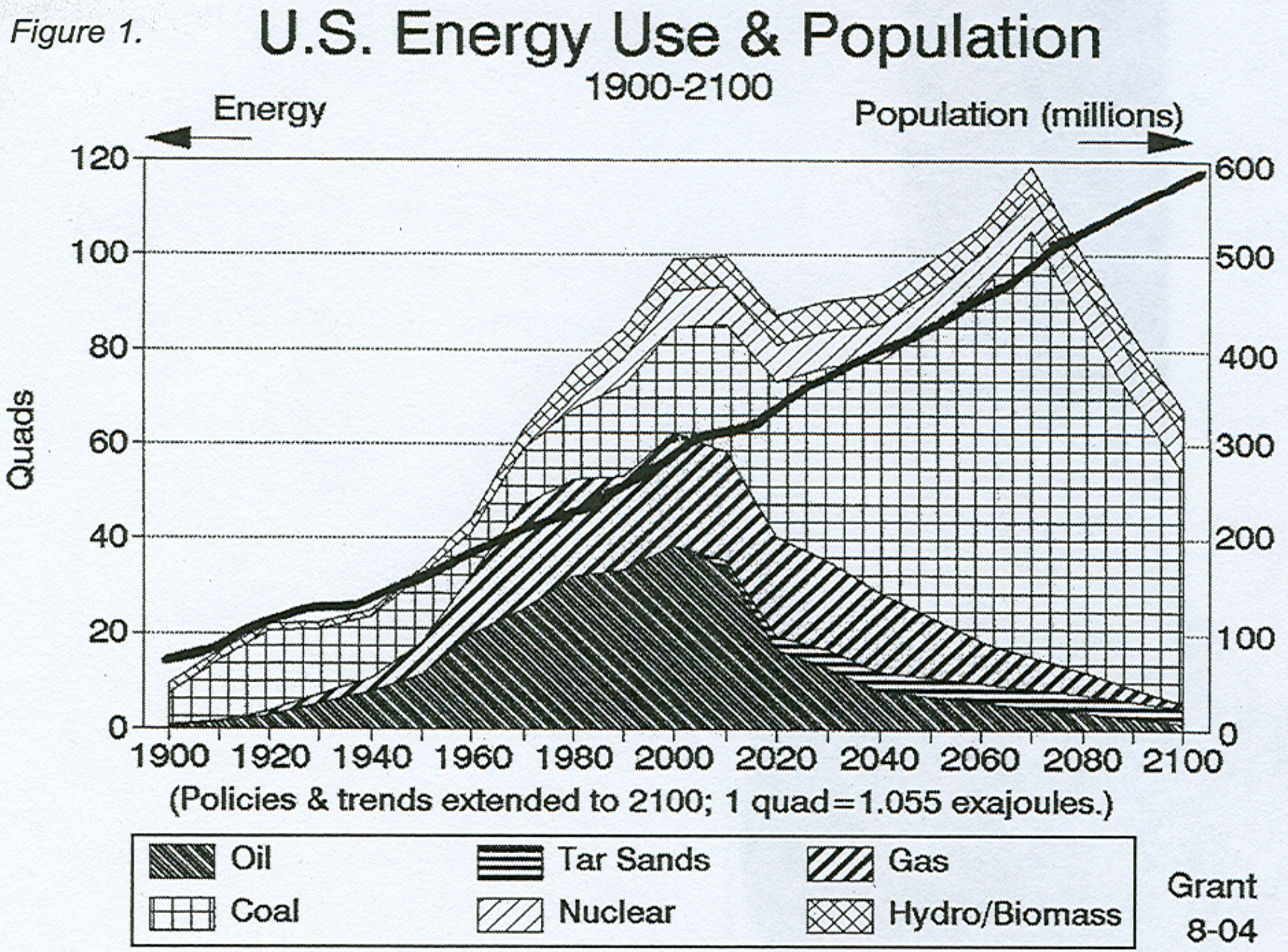
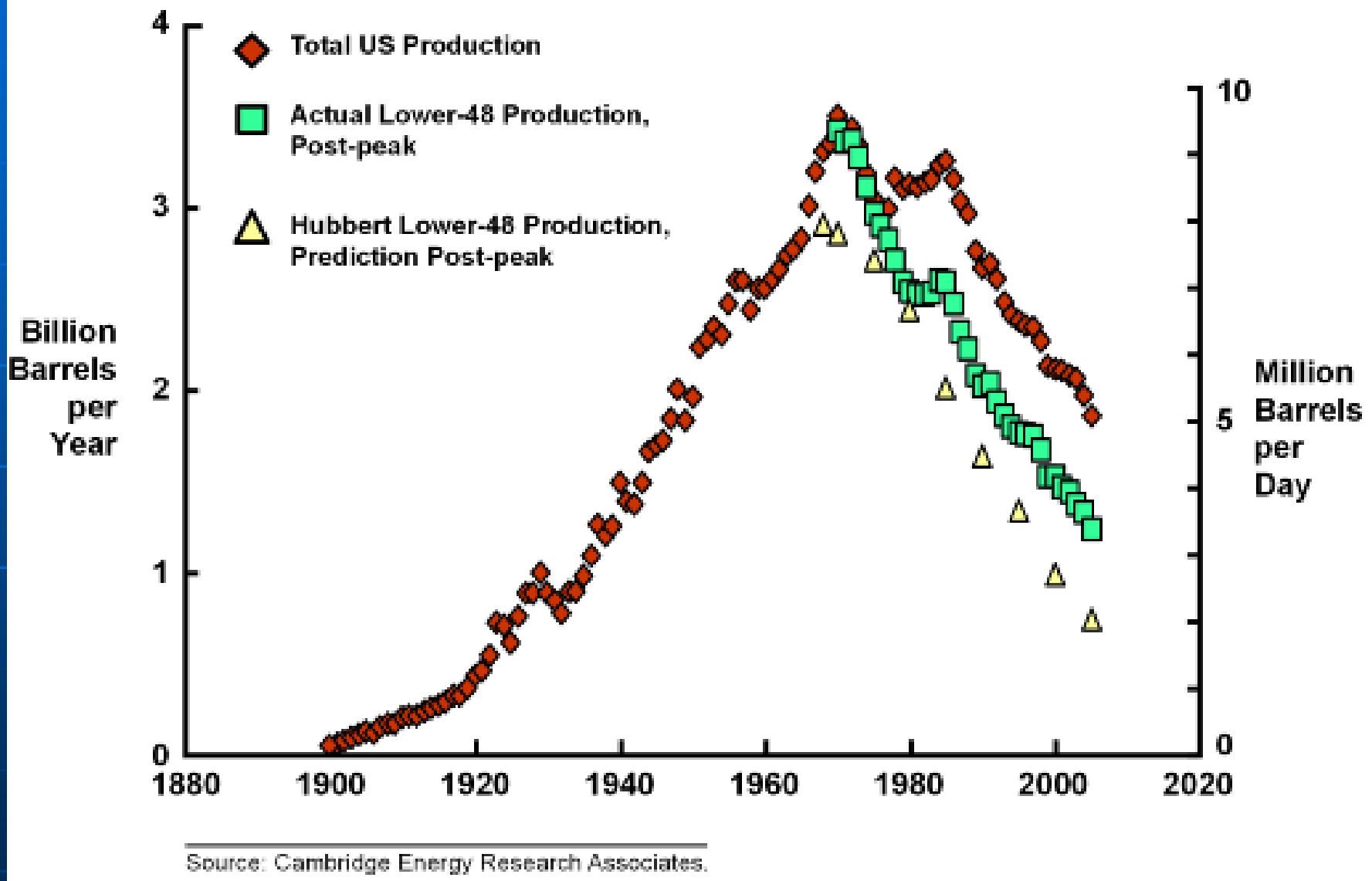


Figure 1.

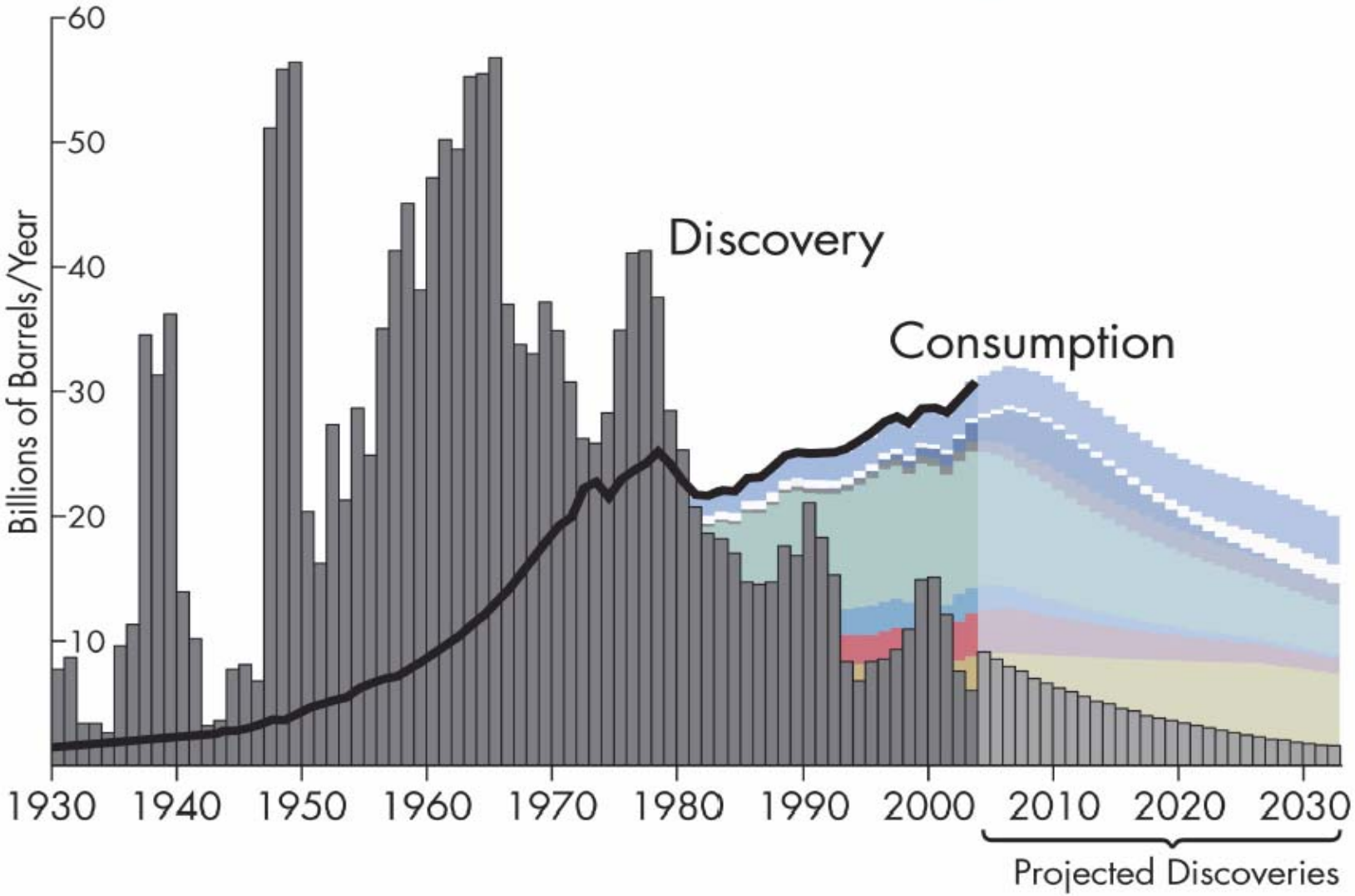

U.S. Energy Use & Population
1900-2100
Energy
Population (millions)
Quads
120
100
80
60
40
20
0
600
500
400
300
200
100
0
1900 1920 1940 1960 1980 2000 2020 2040 2060 2080 2100
(Policies & trends extended to 2100; 1 quad=1.055 exajoules.)
Oil
Coal
Tar Sands
Nuclear
Gas
Hydro/Biomass
Grant
8-04

United States Production, Hubbert versus Actual



Source: Cambridge Energy Research Associates.

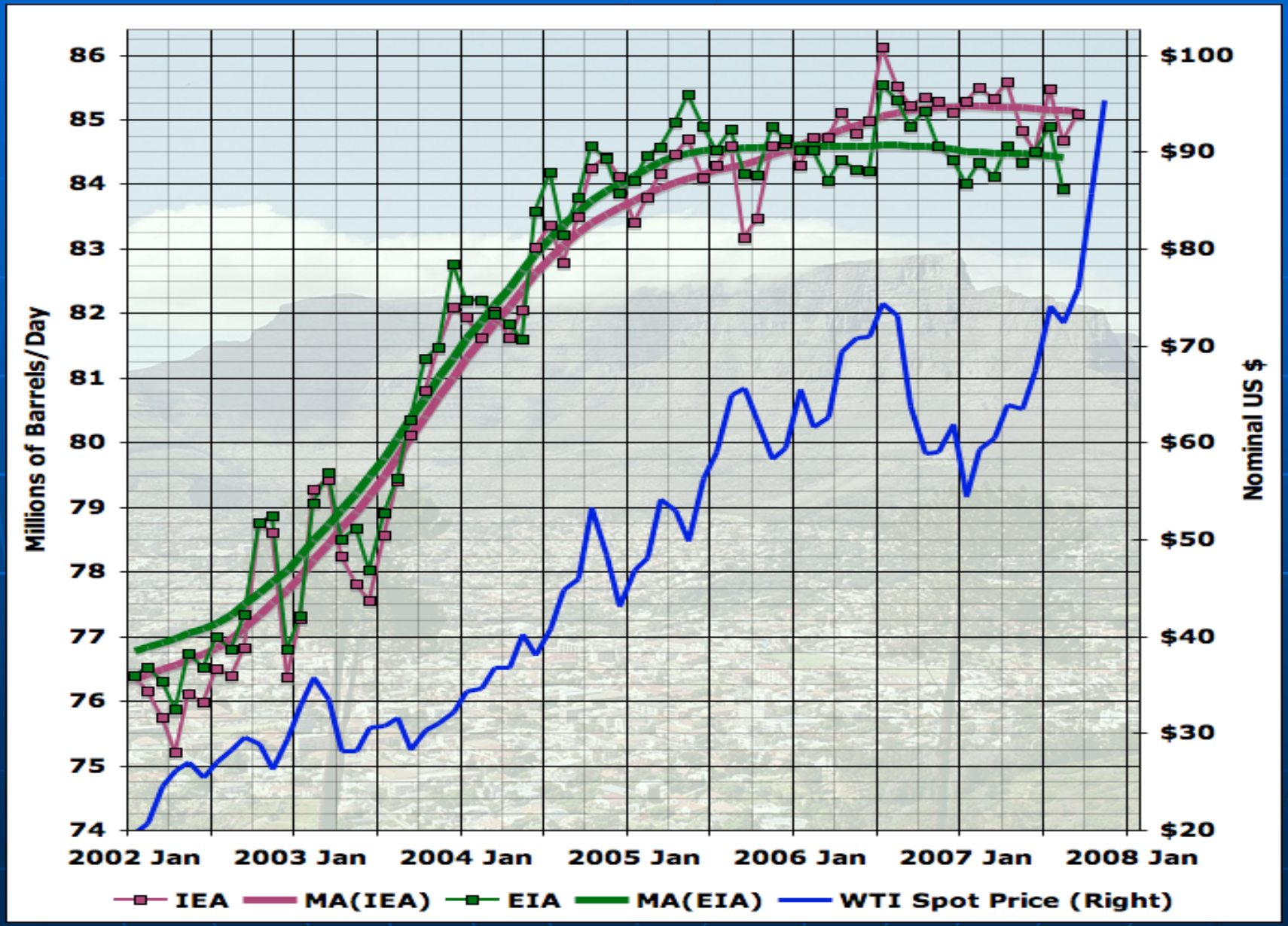
Peak Oil – The Growing Gap



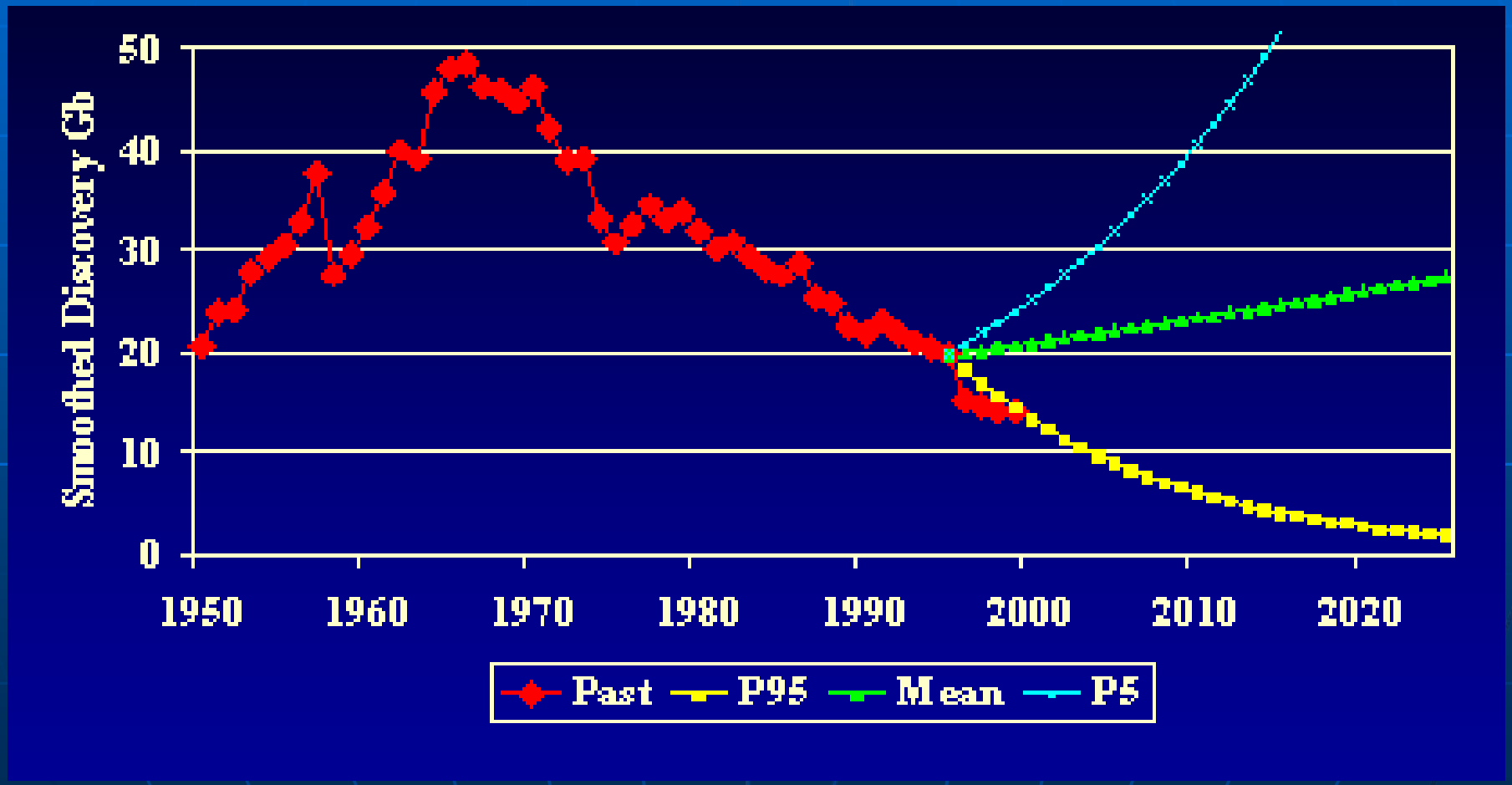
Five Federal Government Peak Oil Reports

- **DOE Report #1 "Hirsch,"** February 2005
- **U.S. Army Corps of Engineers,** September 2005
- **DOE Report #2,** July 8, 2006
- **Government Accountability Office (GAO),** March 29, 2007
- **National Petroleum Council,** Fall, 2007

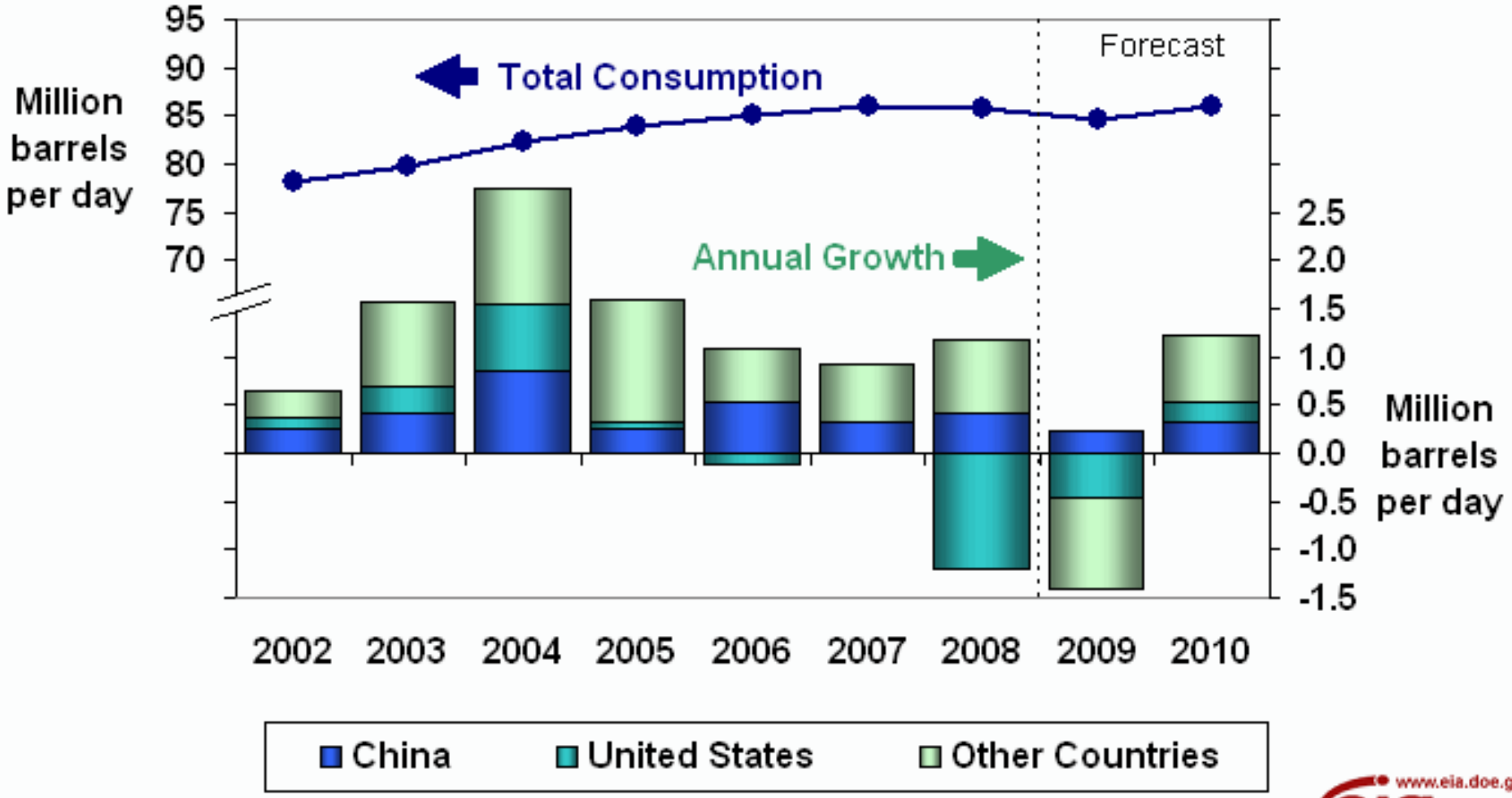
Peak Oil – Are we there yet?



EIA Projections of Discovery



World Oil Consumption



Short-Term Energy Outlook, February 2009

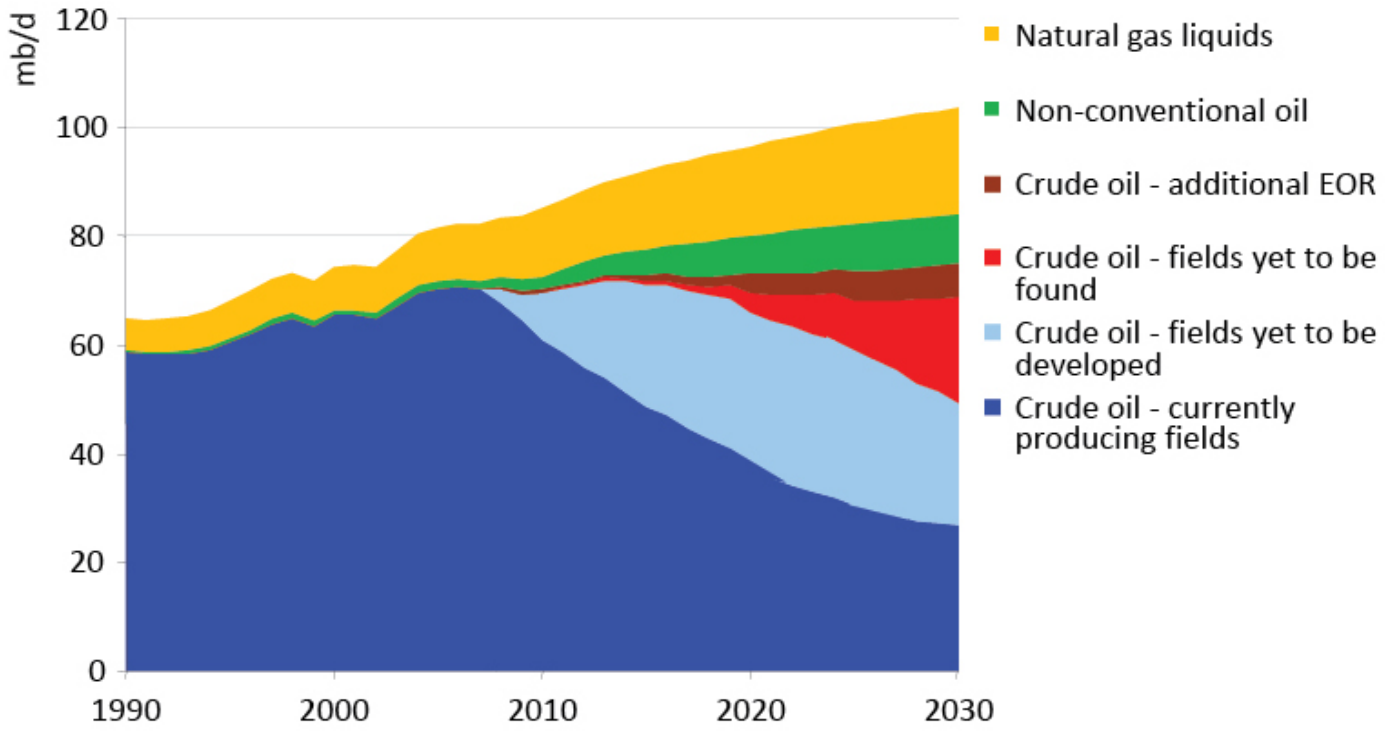
www.eia.doe.gov

IEA World Energy Outlook 2008

- **"Six times the current capacity of Saudi Arabia" will be needed by 2030 "to meet demand growth *AND COUNTER DECLINE*"**

World oil production in the Reference Scenario

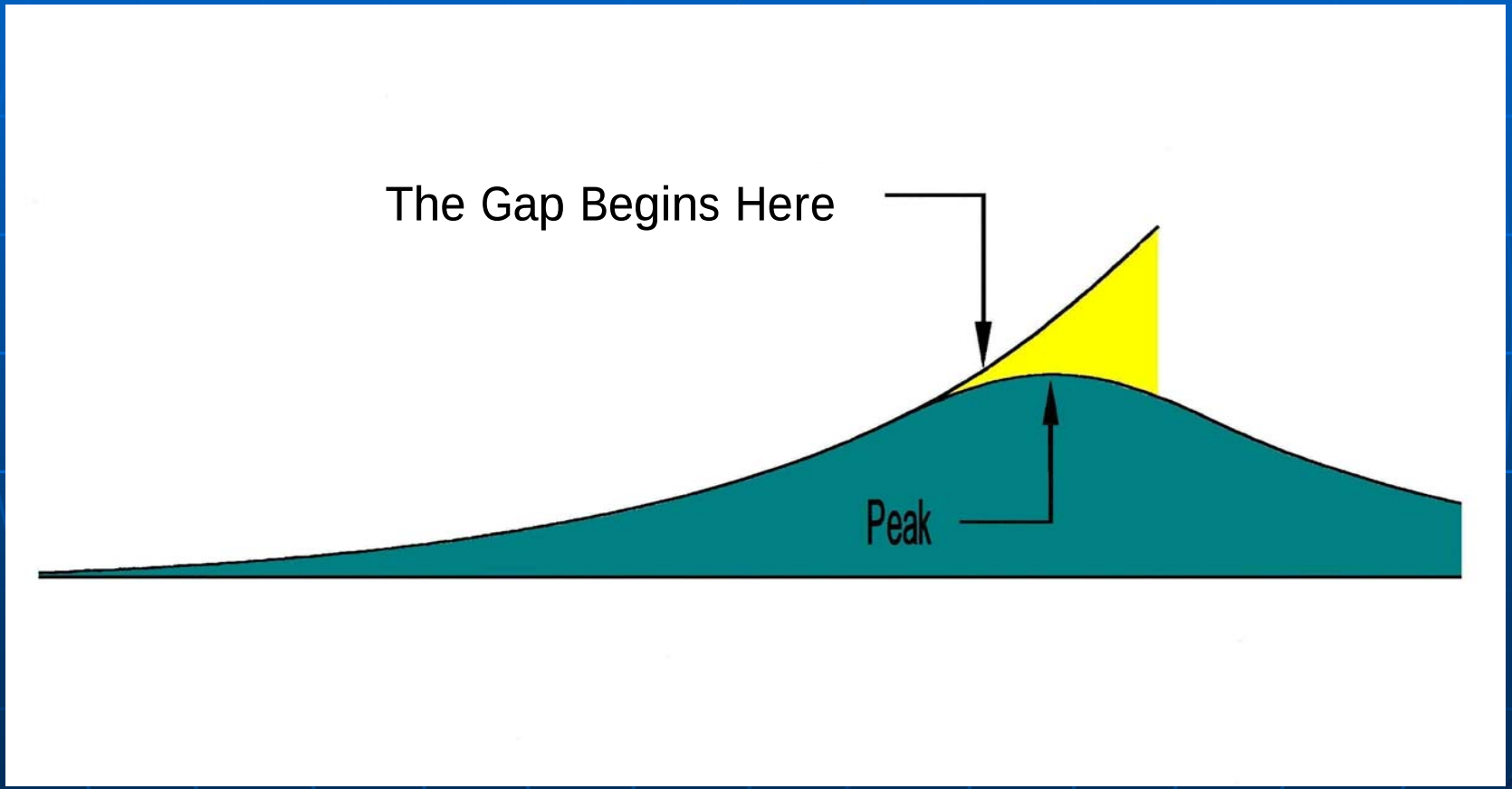
World Energy Outlook 2008



Production reaches 104 mb/d in 2030, requiring 64 mb/d of gross capacity additions – six times the current capacity of Saudi Arabia – to meet demand growth & counter decline

No Silver Bullets to Fill the Gap

There is *NO* Ready Liquid Fuel Substitute!



Congress and Feasibility and Sustainability of Biofuels

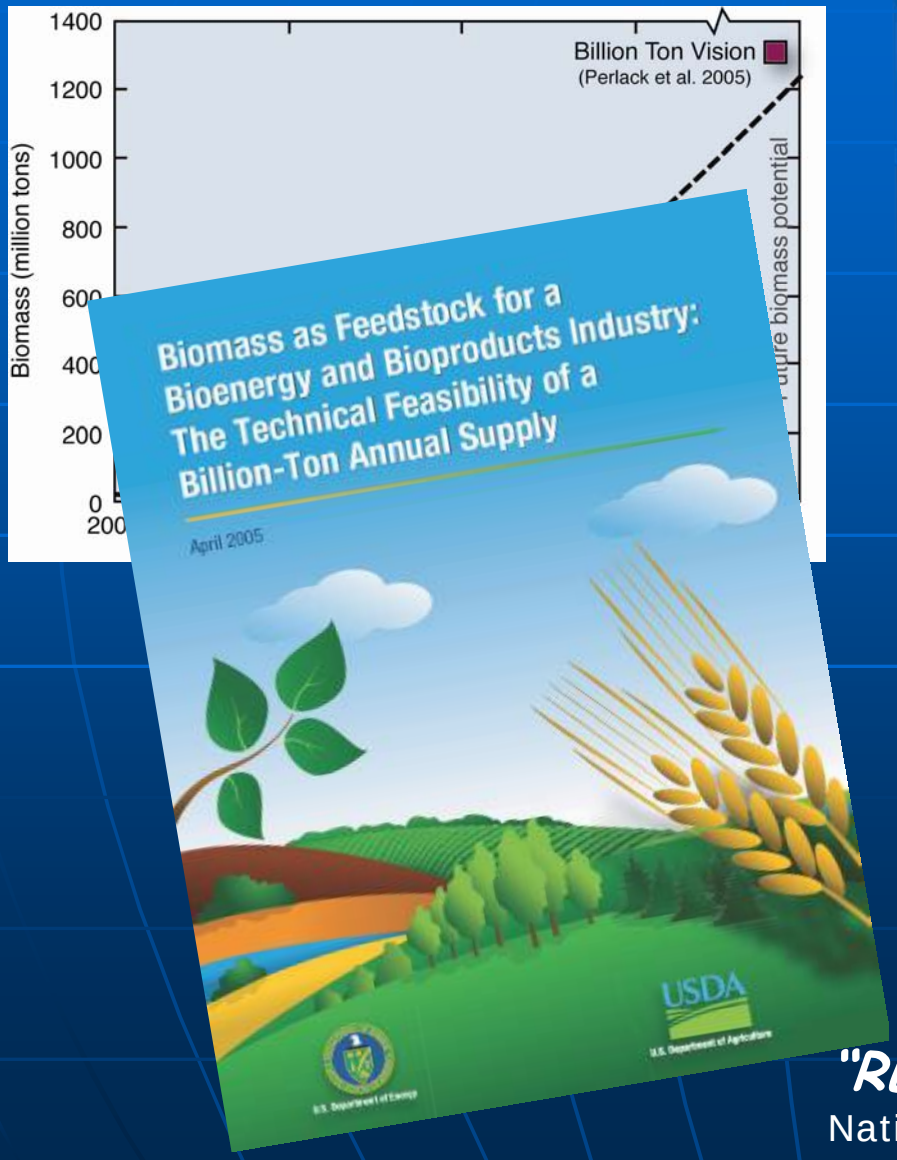
- **Renewable Fuels Standard (RFS)**

  Mandated biofuels production with no requirements for feasibility or sustainability before EISA 2007's requirement for 20% reduction in life-cycle GHG of new biorefineries compared to gasoline/diesel.

  CRS reports: January 23, 2009; February 22, 2008.

- **Bubbles That Have Burst**
  - Hydrogen
  - **Corn Ethanol/Soy Biodiesel**
    - DOE "Billion Ton" report, April 2005
    - National Academies of Science (NAS) report, July 12, 2006; Tilman/Hill, "Ethanol Hype," *The Washington Post*, March 25, 2007; NAS, "REAP," October 17, 2007
    - Biomass Research & Development Initiative (BR&Di) December 2008

Biomass Ethanol Goals

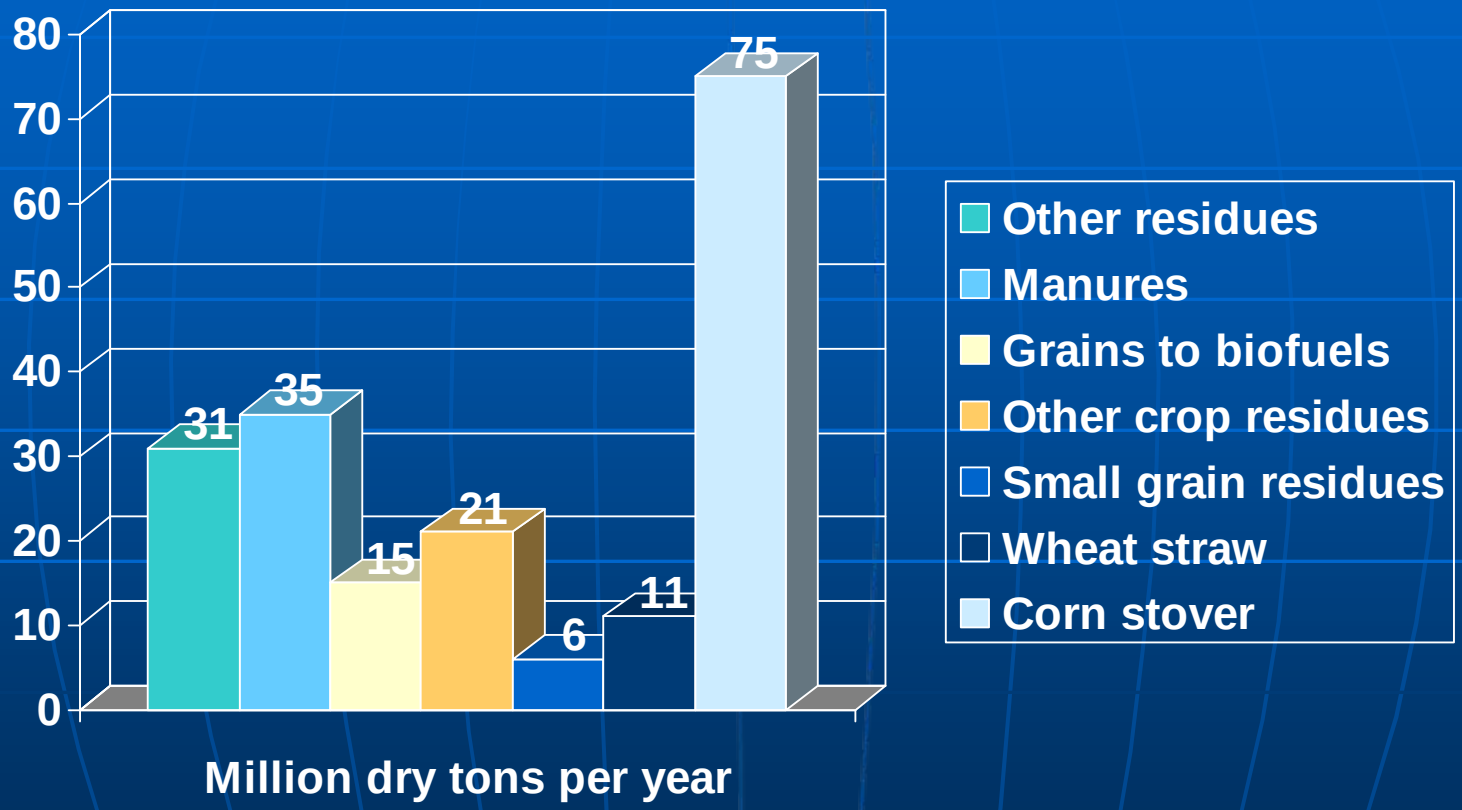


- By 2030, displace 30% of current U.S. petroleum use vs. current 4% vehicle demand displacement (CRS)
- Sustainably produce ONE BILLION TONS* of feedstock annually
  - **Yield increase 50% by 2030**
    - **Corn and small grains**
  - **Residue/grain ratio for soybean increase from 1.5:1 to 2.0:1**
  - **Machine to recover 75% of corn stover**
  - **No tillage adopted universally**

(*0.91 billion Mg)

"REAP: Renewable Energy Assessment Project," National Academies of Science, October 17-18, 2007

Current Availability of Biomass From Agricultural Lands



"Biomass as Feedstock for a **Bi**oenergy and Bioproducts Industry; The Technical Feasibility of a Billion-Ton Annual Supply," DOE, April 2005.

Corn Stover is *NOT* WASTE

Corn Stover Nutrient Replacement Costs

"REAP: Renewable Energy Assessment Project," National Academies of Science, October 17-18, 2007

Element	Amount in stover	Value
	Lbs/ton	$/ton
Nitrogen	16.0	8.00
Phosphorus	1.6	1.52
Potassium	13.5	2.29
Total cost		$11.81

Biofuels Under Development

Cellulosic Ethanol

Biochar

- ***Congressional Research Service: "…three primary *potential benefits* of biochar production via pyrolysis are carbon sequestration, greenhouse gas emission reduction, and soil fertility … Successful implementation of biochar technology [in the U.S.] is rooted in the ability of the agricultural community to afford and operate a system that is complementary to current farming practices."**

Algae

*"Biochar: Examination of an Emerging Concept to Mitigate Climate Change," R40186, CRS, February 3, 2009

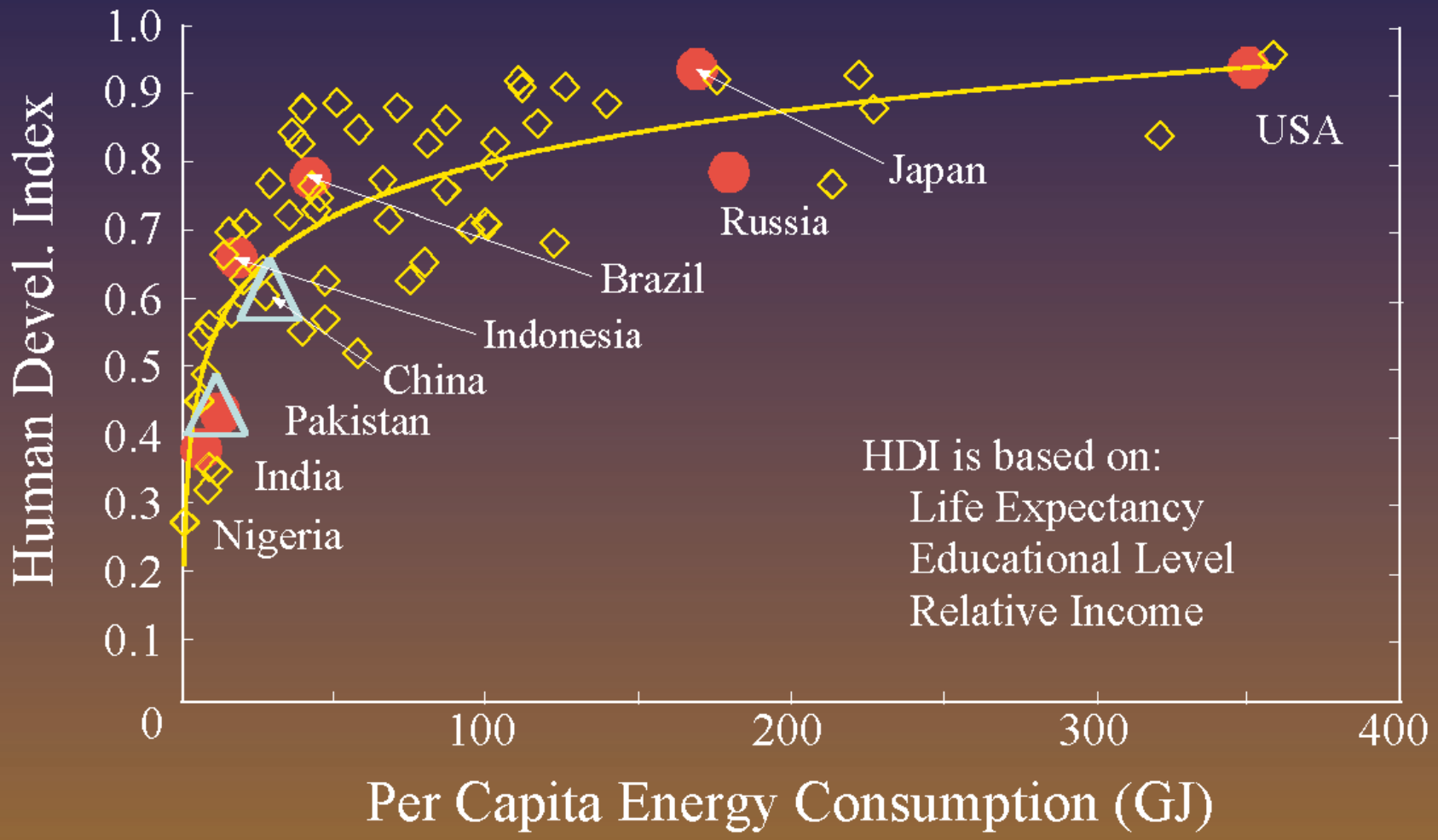
China's "Post-Oil" Strategy

- Conservation
- Domestic Sources of Energy
- Diversify Sources of Energy
- Environmental Impact
- International Cooperation (or confrontation)

America Needs a Sustainable Goal

Innovations to *Live Better, Use Less*

- The total commitment of **WWII**
- The technology intensity and focus of the **Apollo Program** to land a man on the moon **$275 billion** in 2006 dollars
- The urgency of the **Manhattan Project** to develop the atom bomb **$1.1 trillion** in 2006 dollars
- **Mitigate Peak Oil** **$3-4 trillion over 20 years *BEFORE* peak** in 2006 dollars (DOE Peak Oil Reports #1 and #2)


Human Devel. Index
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100
200
300
400
Per Capita Energy Consumption (GJ)
USA
Japan
Russia
Brazil
Indonesia
China
Pakistan
India
Nigeria
HDI is based on:
Life Expectancy
Educational Level
Relative Income

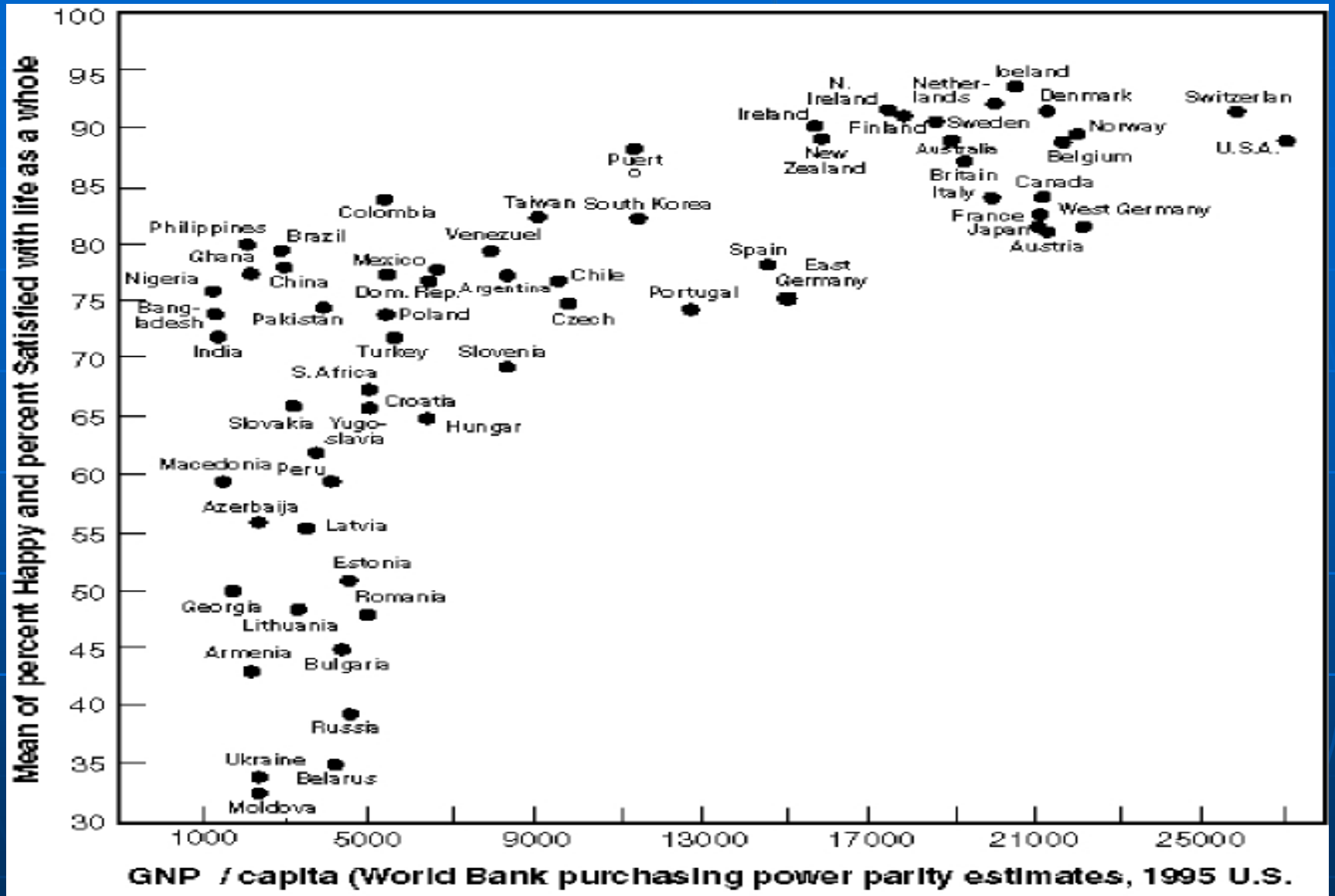


Figure 2. Subjective well-being by level of economic development.
Source: World Values Surveys; GNP/capita purchasing power estimates from World Bank, World Development Report, 1997.
$R = .70$ $N = 65$ $p < .0000$

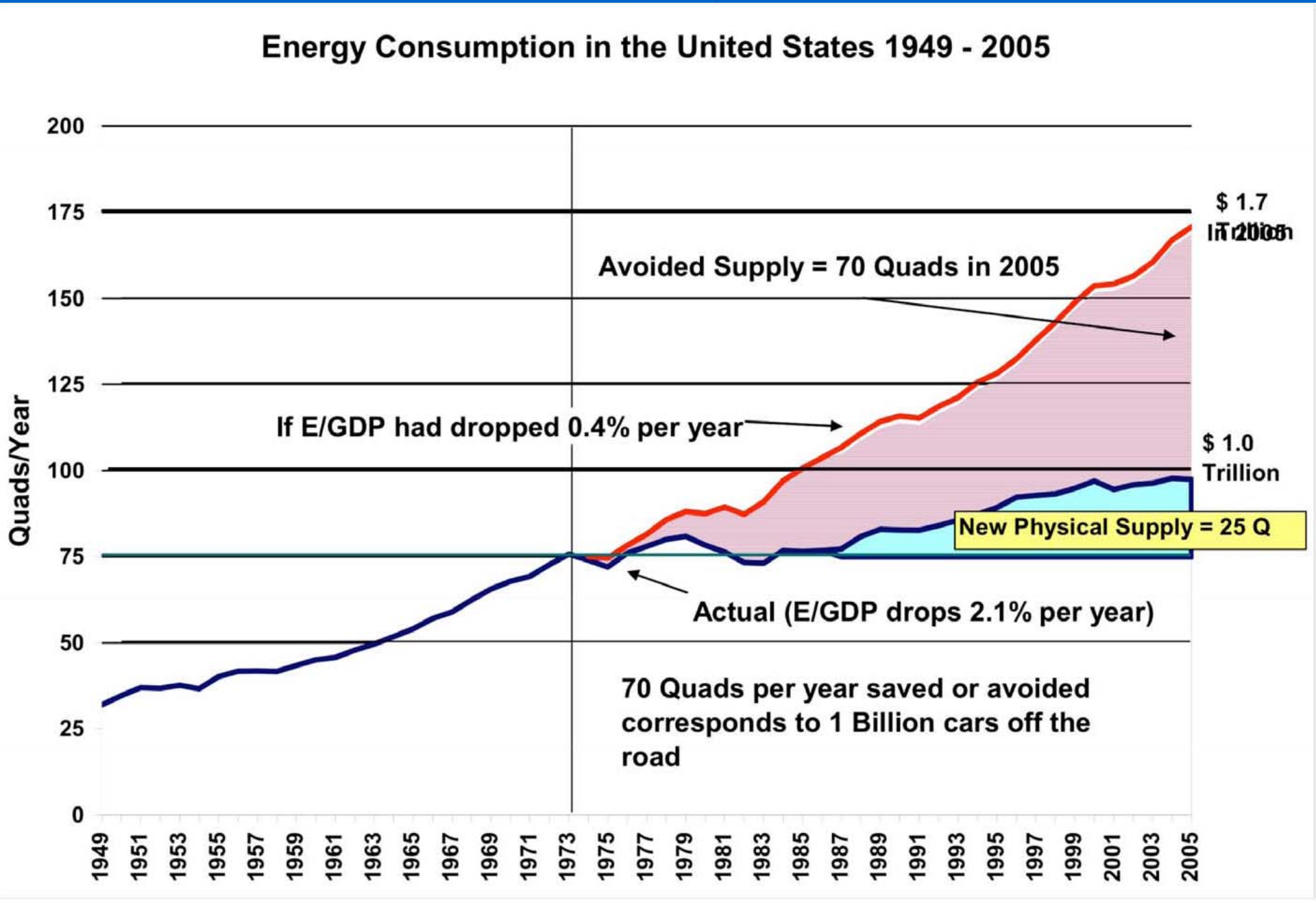
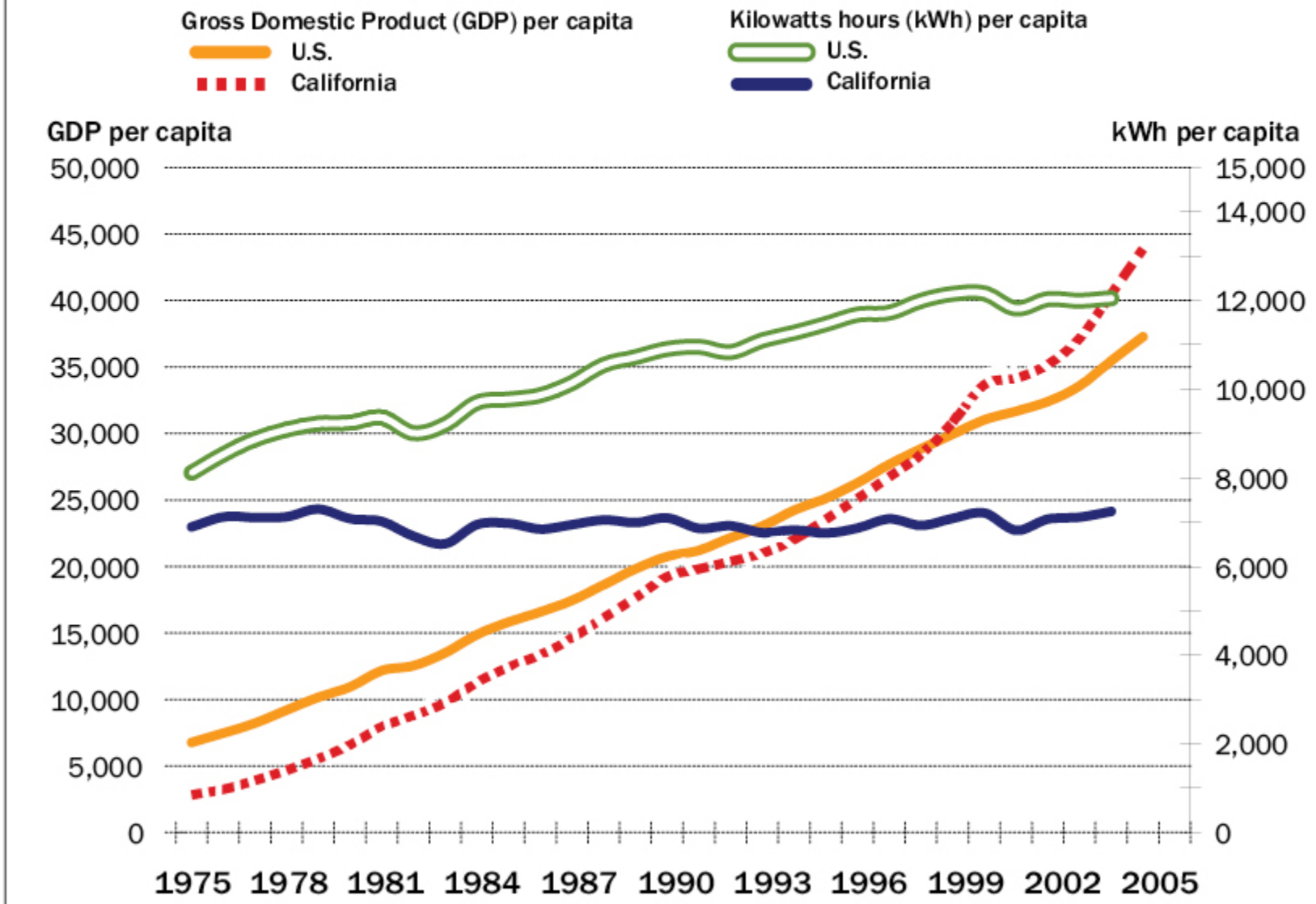

Energy Consumption in the United States 1949 - 2005
Quads/Year
200
175
150
125
100
75
50
25
0
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
$ 1.7
Trillion
Avoided Supply = 70 Quads in 2005
If E/GDP had dropped 0.4% per year
$ 1.0
Trillion
New Physical Supply = 25 Q
Actual (E/GDP drops 2.1% per year)
70 Quads per year saved or avoided corresponds to 1 Billion cars off the road

Figure 3

Electricity usage and economic growth for California and the United States



Source: California Energy Commission

We are all in the same boat!

For More Information

http://www.bartlett.house.gov/EnergyUpdates